

# INSTRUCTION MANUAL

# Orion<sup>®</sup> SkyView<sup>™</sup> Pro 80mm ED EQ

Equatorial Apochromatic Refractor Telescope

#9884



 **ORION<sup>®</sup>**  
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**Figure 1.** The SkyPro 80mm ED EQ.

*Congratulations on your purchase of a quality Orion telescope. Your new SkyView Pro 80mm ED EQ is an exceptional instrument for observing and imaging astronomical objects. The ED glass of the objective lens ensures you'll enjoy star, Moon, and planetary images with far less color distortion than seen in standard refractors. Other features, such as the smooth Crayford focuser, precision machined lens cell, and deluxe aluminum focusing wheels also attest to the overall high quality of the telescope. With the sturdy SkyView Pro equatorial mount, you'll be able to enjoy steady viewing of thousands of the night sky's fascinating celestial targets.*

These instructions will help you set up, properly use, and care for your telescope. Please read them over thoroughly before getting started.

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**WARNING:** *Never look directly at the Sun through your telescope or its finder scope—even for an instant—without a professionally made solar filter that completely covers the front of the instrument, or permanent eye damage could result. Young children should use this telescope only with adult supervision.*

## 1. Unpacking

The SkyView Pro 80mm ED EQ will arrive in one box; be careful unpacking the box. We recommend keeping the box and all original packaging. In the event that the telescope needs to be shipped to another location, or returned to Orion for warranty repair, having the proper box and packaging will help ensure that your telescope will survive the journey intact.

Make sure all the parts in the Parts List are present. Be sure to check each box carefully, as some parts are small. If anything appears to be missing or broken, immediately call Orion Customer Support (800-676-1343) or email [support@telescope.com](mailto:support@telescope.com) for assistance.

## 2. Parts List

### Box #1: Optical Tube Assembly and Accessories

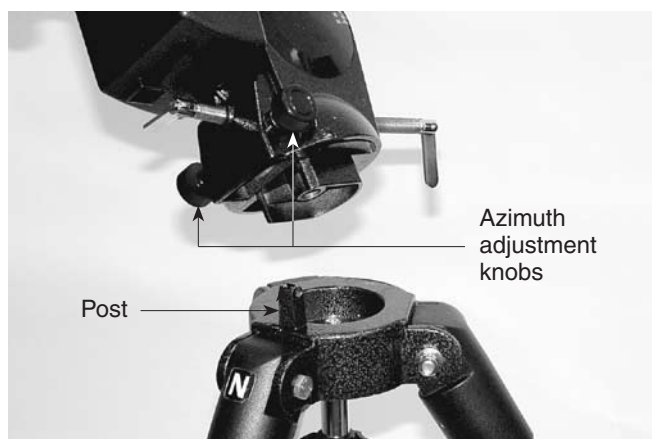
Qty.	Description
1	Tripod
1	Equatorial mount
1	Tripod support tray
1	Central support shaft (attached to tripod)
1	Tube ring mounting plate
2	Tube rings with mounting screws
1	Counterweight shaft
1	Counterweight
2	Slow-motion control knobs
1	R.A. axis rear cover
2	Latitude adjustment L-bolts
1	Optical tube assembly
1	25mm Sirius Plössl eyepiece, 1.25" barrel diameter
1	10mm Sirius Plössl eyepiece, 1.25" barrel diameter
1	2" Star diagonal with 1.25" adapter
1	Finder scope
1	Finder scope bracket with O-ring
1	Dust cover (attached to optical tube)
1	Camera adapter (attached to optical tube)
1	Small crescent wrench

## 3. Assembly

Assembling the telescope for the first time should take about 30 minutes. No tools are needed other than the provided crescent wrench. All screws should be tightened securely, but be careful not to over-tighten or the threads may strip. Refer to Figure 1 during the assembly process.

During assembly (and anytime, for that matter), do not touch the surfaces of the lenses of the telescope, finder scope, or eyepieces with your fingers. The optical surfaces have delicate coatings on them that can easily be damaged if touched inappropriately. Never remove any lens assembly from its housing for any reason, or the product warranty and return policy will be voided.

1. Stand the tripod legs upright and spread the legs out as far as they will go. Keep the tripod legs at their shortest (fully retracted) length, for now; you can extend them to a more desirable length later, after the scope is fully assembled.
2. Place the base of the equatorial mount into the tripod head. Orient the equatorial mount so that the post on the tripod head lines up with the azimuth adjustment knobs on the equatorial mount (Figure 2). You may need to loosen the azimuth adjustment knobs on the equatorial mount in order to fit the mount onto the tripod head.



**Figure 2.** Orient the equatorial mount so that the post on the tripod head lines up with the azimuth adjustment knobs on the equatorial mount.

3. Thread the central support shaft into the equatorial mount until tight. This will secure the equatorial mount to the tripod head.
4. Remove the knob and washer from the bottom of the center support shaft. Slide the tripod support tray up the bottom of the central support shaft until the three tray arms are touching the legs of the tripod. The flat side of the accessory tray should be facing up. Make sure the “V” of each tray arm is against a tripod leg. Place the washer back on the center support shaft against the tray, and thread the securing knob all the way up the center support shaft until it is tight against the tray. The tripod support tray provides additional stability for the tripod, and holds five 1.25" eyepieces and two 2" eyepieces.
5. Thread the latitude adjustment L-bolts into the equatorial mount where shown in Figure 1. Thread one L-bolt in about halfway, then thread the other L-bolt in until tight.
6. Thread the counterweight shaft into the equatorial mount at the base of the declination axis until tight. Make sure the casting at the top of the shaft is threaded clockwise as far as it will go before attaching the shaft. Once the shaft is installed, turn the casting counter-clockwise until the top of the casting is flush with the mount.
7. Remove the knurled “toe saver” retaining screw on the bottom of the counterweight shaft and slide the counterweight onto the shaft. Make sure the counterweight lock knob is adequately loosened to allow the counterweight shaft to

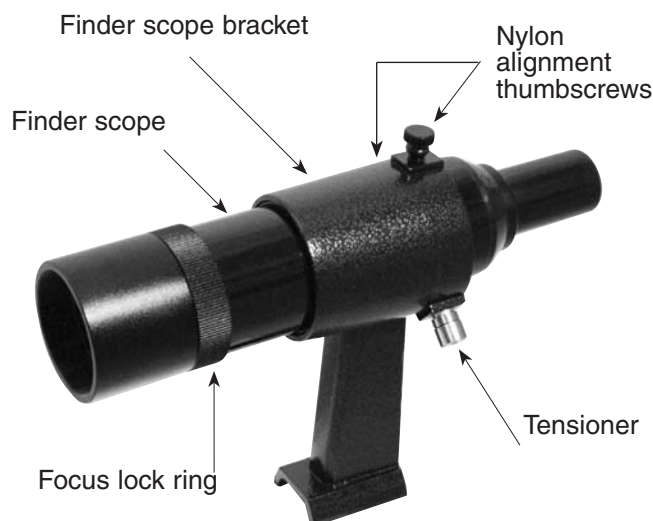
pass through the hole. Position the counterweight about halfway up the shaft and tighten the lock knob. Replace the toe saver at the end of the bar. The toe saver prevents the counterweight from falling on your foot if the lock knob happens to come loose.

8. Attach the slow-motion control knobs to the right ascension and declination worm gear shafts of the equatorial mount by sliding them onto the shafts. Line up the flat on the end of the shaft with the corresponding feature on the interior of the knob to connect them properly. The knobs can be attached to either end of the shafts; use whichever end is most convenient.
9. Attach the tube mounting rings to the tube ring mounting plate using the attachment screws that are on the tube rings. The screws should go through the holes on the outer ends of the mounting plate and rethread into the tube rings. Note that the side of the mounting plate with the central “groove” will be facing up. Use the small crescent wrench to secure the tube rings to the mounting plate.
10. Loosen the black mounting plate securing knob as well as the metal safety screw on the top of the equatorial mount. Place the tube ring mounting plate, with the tube rings attached, in the dovetail slot on top of the equatorial mount. Position the mounting plate so that it is centered on the dovetail slot. Re-tighten the mounting plate securing knob until the mounting plate is secure. Then, tighten the safety screw. The safety screw will ensure that the mounting plate (and telescope tube) will not fall off the EQ mount if the mounting plate securing knob should come loose.
11. Lay the telescope optical tube in the tube rings at about the midpoint of the tube's length. Center the 1/4"-20 mounting block on the optical tube relative to the tube rings. Positioning the optical tube this way will automatically balance the telescope in declination (see section 4). Rotate the optical tube so that the focus wheels are pointed down. Close the rings over the tube and tighten the knurled ring clamps finger-tight to secure the telescope in position.

### Installing the Finder Scope

To place the finder scope (Figure 3a) in the finder scope bracket, unthread the two black nylon screws until the screw ends are flush with the inside diameter of the bracket. Place the O-ring that comes on the base of the bracket over the body of the finder scope until it seats into the slot on the middle of the finder scope. Slide the eyepiece end (narrow end) of the finder scope into the end of the bracket's cylinder opposite the adjustment screws while pulling the chrome, spring-loaded tensioner on the bracket with your fingers (Figure 3b). Push the finder scope through the bracket until the O-ring seats just inside the front opening of the bracket cylinder. Release the tensioner and tighten the two black nylon screws a couple of turns each to secure the finder scope in place. Insert the base of the finder scope bracket into the dovetail holder on top of the focuser. Lock the bracket into position by tightening the knurled thumb screw on the dovetail holder.





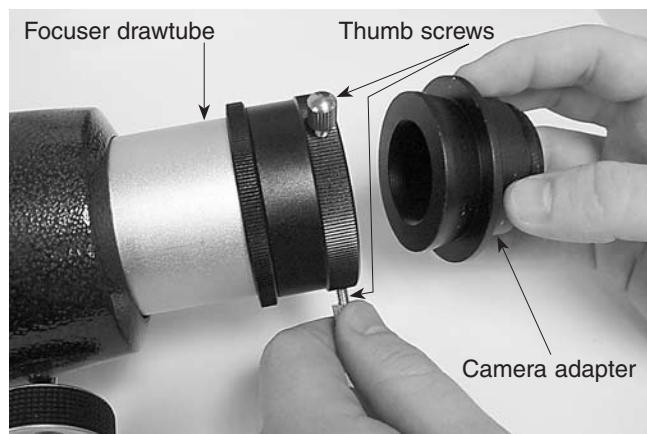
**Figure 3a.** The 8x40 finder scope.



**Figure 3b.** Pull-back on the tensioner and slide the finder scope into its bracket until the O-ring is seated in the bracket ring.

### Inserting the Diagonal and Eyepiece

The SkyView Pro 80mm ED EQ comes with a camera adapter attached to its focuser drawtube. Loosen the two thumb screws securing the camera adapter to the focuser drawtube and remove the camera adapter (see Figure 4). Insert the chrome barrel of the star diagonal into the focuser and secure it with the thumb screws on the drawtube. The star diagonal comes with a 1.25" adapter in it; this part allows for use of 1.25" barrel diameter eyepieces in the 2" diameter diagonal (see Figure 5). Make sure the 1.25" adapter is secure in the diagonal by tightening the thumb screw on the diagonal. Loosen the thumb screw on the 1.25" adapter and insert the barrel of the 25mm eyepiece into it. Secure the eyepiece with the thumb screw on the 1.25" adapter.



**Figure 4.** Before installing the 2" star diagonal, you must remove the camera adapter that comes attached to the telescope.



**5a.**



**5b.**

**Figure 5a. and 5b.** To use 1.25" barrel diameter eyepieces, the 1.25" adapter must be installed in the 2" star diagonal. 5b. To use 2" eyepieces, remove the 1.25" adapter.

Your telescope is now completely assembled and should appear as shown in Figure 1.

## 4. Balancing the Telescope

To ensure smooth movement of the telescope on both axes of the equatorial mount, it is imperative that the optical tube is properly balanced. You will only need to balance the telescope with respect to the right ascension (R.A.) axis; the telescope should be balanced on the declination (Dec.) axis already if you have properly centered the 1/4"-20 mounting block on the optical tube relative to the tube rings.

1. Keeping one hand on the telescope optical tube, loosen the R.A. lock lever. Make sure the Dec. lock lever is locked, for now. The telescope should now be able to rotate freely about the right ascension axis. Rotate it until the counterweight shaft is parallel to the ground (i.e., horizontal).
2. Loosen the counterweight lock knob and slide the weight along the shaft until it exactly counterbalances the tele-

scope (Figure 6a). That's the point at which the shaft remains horizontal even when you let go with both hands (Figure 6b).

3. Retighten the counterweight lock knob. The telescope is now balanced on the right ascension axis.

Now when you loosen the lock lever on one or both axes and manually point the telescope, it should move without resistance and should not drift from where you point it.



**Figure 6a, 6b.** Proper operation of the equatorial mount requires that the telescope tube be balanced on the R.A. axis. (a) With the R.A. lock lever released, slide the counterweights along the counterweight shaft until it just counterbalances the tube. (b) When you let go with both hands, the tube should not drift up or down. The-telescope tube should already be balanced in the Dec. axis if you have properly centered the 1/4" mounting block between the tube rings.

## 5. Using Your Telescope

This section will get you used to the functions and features of your new telescope.

### Focusing the Telescope

With the 25mm eyepiece inserted in the diagonal, move the telescope so the front (open) end is pointing in the general direction of an object at least 1/4-mile away. Now, with your

fingers, slowly rotate one of the focus knobs until the object comes into sharp focus. Go a little bit beyond sharp focus until the image just starts to blur again, then reverse the rotation of the knob, just to make sure you've hit the exact focus point.

**Note: The image in the telescope will appear reversed left-to-right.. This is normal for astronomical telescopes that utilize a star diagonal. The finder scope view will be rotated 180°. (Figure 7)**

If you have trouble focusing, rotate the focus knob so the drawtube is in as far as it will go. Now look through the eyepiece while slowly rotating the focus knob in the opposite direction.



Naked-eye view



View through finder scope and telescope

**Figure 7.** The view through a standard finder scope and reflector telescope is rotated 180°. This is true for the SkyView Pro 80mm ED EQ and its finder scope as well.

You should soon see the point at which focus is reached.

### Note About the Crayford Focuser

The SkyView Pro 80mm ED EQ comes equipped with a Crayford focuser. The Crayford design allows for smooth, precise focusing without any image shift that typical rack-and-pinion designs experience. If you find that the focus knobs are too tight or too loose, you can make adjustments to the focuser tension by using the focuser tension thumb screw located on the bottom of the optical tube. Make adjustments to this thumb screw until the focuser motion feels comfortable, but you must have at least some tension applied to the focuser drawtube, or else it will not move when you turn the focus knobs.

### Viewing with Eyeglasses

If you wear eyeglasses, you may be able to keep them on while you observe, if the eyepiece has enough "eye relief" to allow you to see the whole field of view. You can try this by looking through the eyepiece first with your glasses on, and then with them off, and see if the glasses restrict the view to only a portion of the full field. If they do, you can easily observe with your glasses off by just re-focusing the telescope the needed amount. If you suffer from severe astigmatism, however, you may find images noticeably sharper with your glasses on.

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### Aligning the Finder Scope

The SkyView Pro 80mm ED EQ comes with a 8x40 achromatic finder scope (Figure 3a). The number 8 means eight-times magnification and the 40 indicates a 40mm diameter front lens. The finder scope makes it easier to locate the object you want to observe in the telescope, because the finder scope has a much wider field-of-view.

The finder scope uses a spring-loaded bracket that makes alignment of the finderscope very easy. As you turn either of the thumb screws, the spring in the bracket's tensioner moves in and out to keep the finder scope secure in the bracket.

The finder scope must be aligned accurately with the telescope for proper use. To align it, first aim the main telescope at an object at least a 1/4 mile away - the top of a telephone pole, a chimney, etc. First loosen the R.A. and Dec. lock levers and move the telescope until it is pointing towards the desired object. Then sight along the tube to precisely aim the telescope. Turn the focus knob until the object is properly focused. Make sure to position the object in the center of the telescope's eyepiece by turning the R.A. and declination slow-motion control knobs (the R.A. and Dec. lock levers must be tightened to use the slow-motion control knobs).

Now look in the finder scope. Is the object visible? Ideally it will be somewhere in the field of view. If not, some coarse adjustment to the finder scope bracket's alignment thumb screws will be needed until the object comes into the finder scope's field of view.

With the image in the finder scope's field of view, you now need to fine-adjust the alignment thumb screws to center the object on the intersection of the crosshairs. Adjust the aim of the finder scope by turning the thumb screws, one at a time, until the object is centered. Make sure the object is still centered in the telescope's eyepiece as well. If it isn't, you will need to repeat the entire process.

The finder scope alignment needs to be checked before every observing session. This can easily be done at night, before viewing through the telescope. Choose any bright star or planet, center the object in telescope eyepiece, and then adjust the finder scope bracket's alignment thumb screws until the star or planet is centered on the finder's crosshairs.

### Focusing the Finder Scope

If, when you look through the finder scope, the images appear somewhat out of focus, you will need to refocus the finder scope for your eyes. Loosen the lock ring located behind the objective lens cell on the body of the finder scope (see Figure 3a). Back the lock ring off by a few turns, for now. Refocus the finder scope on a distant object by threading the objective lens cell in or out of the finder scope body. Precise focusing will be achieved by focusing the finder scope on a bright star. Once the image appears sharp, retighten the lock ring behind the objective lens cell. The finder scope's focus should not need to be adjusted again.

### Magnification & Eyepieces

Magnification, or power, is determined by the focal length of the telescope and the focal length of the eyepiece. Therefore, by using eyepieces of different focal lengths, the resultant magnification can be varied.

Magnification is calculated as follows:

$$\text{Magnification} = \frac{\text{Telescope Focal Length (mm)}}{\text{Eyepiece Focal Length (mm)}}$$

The SkyView Pro 80mm ED EQ has a focal length of 600mm, which when used with the supplied 25mm eyepiece yields:

$$\frac{600 \text{ mm}}{25 \text{ mm}} = 24x$$

The magnification provided by the 10mm eyepiece is:

$$\frac{600 \text{ mm}}{10 \text{ mm}} = 60x$$

The maximum attainable magnification for a telescope is directly related to how much light it can gather. The larger the aperture, the more magnification is possible. In general a figure of 2x per millimeter of aperture is the maximum attainable for most telescopes. Your SkyView Pro 80mm ED EQ has an aperture of 80 millimeters, so the maximum magnification would be about 160x. This level of magnification assumes you have ideal conditions for viewing.

Keep in mind that as you increase magnification, the brightness of the object viewed will decrease; this is an inherent principle of the laws of physics and cannot be avoided. If magnification is doubled, an image appears four times dimmer. If magnification is tripled, image brightness is reduced by a factor of nine!

Always start with your lowest power eyepiece and work your way up. Start by centering the object being viewed in the 25mm eyepiece. Then increase the magnification to get a closer view, if you wish. If the object is off-center (i.e., it is near the edge of the field of view) you will lose it when you increase magnification, since the field of view will be narrower with the higher-powered eyepiece. To change eyepieces, first loosen the securing thumb screw on the 1.25" adapter on the star diagonal. Then carefully lift the eyepiece out of the holder. Do not tug or pull the eyepiece to the sides, as this will knock the telescope off its target. Replace the eyepiece with the new one by sliding it gently into the holder. Re-tighten the thumb screw, and refocus for your new magnification.

### Use of 2" Eyepieces

A feature of the SkyView Pro 80mm ED EQ is its ability to use either 1.25" or 2" barrel-diameter eyepieces. At low magnifications, 2" eyepieces can give a wider field of view than standard 1.25" eyepieces. This is especially desirable for observing deep-sky objects, as many of them appear quite large, but

faint. Many observers own at least one 2" eyepiece in order to achieve the widest field of view possible for deep sky-observing. The expansive view will make you feel like you're floating in space!

To use 2" eyepieces, simply loosen the thumb screw on the star diagonal that secures the 1.25" adapter, and remove the adapter. Insert a 2" eyepiece directly into the diagonal, and secure it in place with the thumb screw on the diagonal. You are now ready to observe with the 2" eyepiece. If you attempt to place a 2" eyepiece directly into the focuser drawtube without using the star diagonal, images will not come into focus. If you wish to view with 2" eyepieces without using the diagonal, you will need to purchase an optional 2" extension tube.

### Note About Chromatic Aberration

Chromatic aberration literally means color distortion. Whenever light passes through one material to another, light of different wavelengths (color) is bent by different amounts. This is a problem that plagues refractor-type telescopes, since light passes through both air and glass to form an image. Most astronomical objects emit a spectrum comprised of many different wavelengths of light, so each wavelength will be bent by a slightly different amount when passing through a lens. This results in each color of light reaching precise focus at a slightly different point, which will provide unacceptable images.

The 80mm ED is designed to minimize chromatic aberration. The objective lens is actually comprised of two individual lenses, called elements, one of which is made of ED (Extra-low Dispersion) glass, a special type of glass that has superior refractive properties when compared to normal types of glass. The use of this ED glass minimizes the amount of chromatic aberration, resulting in a much more pleasing view when compared to telescopes that do not use ED glass.

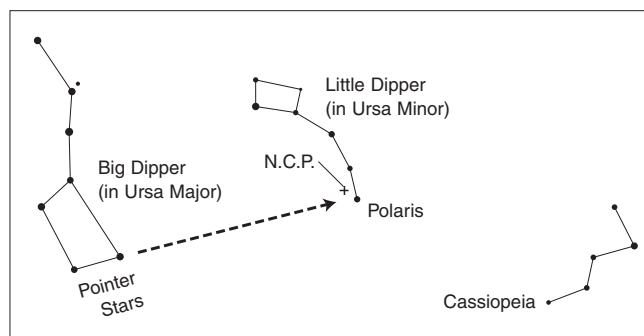
## 6. Setting Up and Using the Equatorial Mount

When you look at the night sky, you no doubt have noticed that the stars appear to move slowly from east to west over time. That apparent motion is caused by the Earth's rotation (from west to east). An equatorial mount (Figure 8) is designed to compensate for that motion, allowing you to easily "track" the movement of astronomical objects, thereby keeping them from drifting out of your telescope's field of view while you're observing.

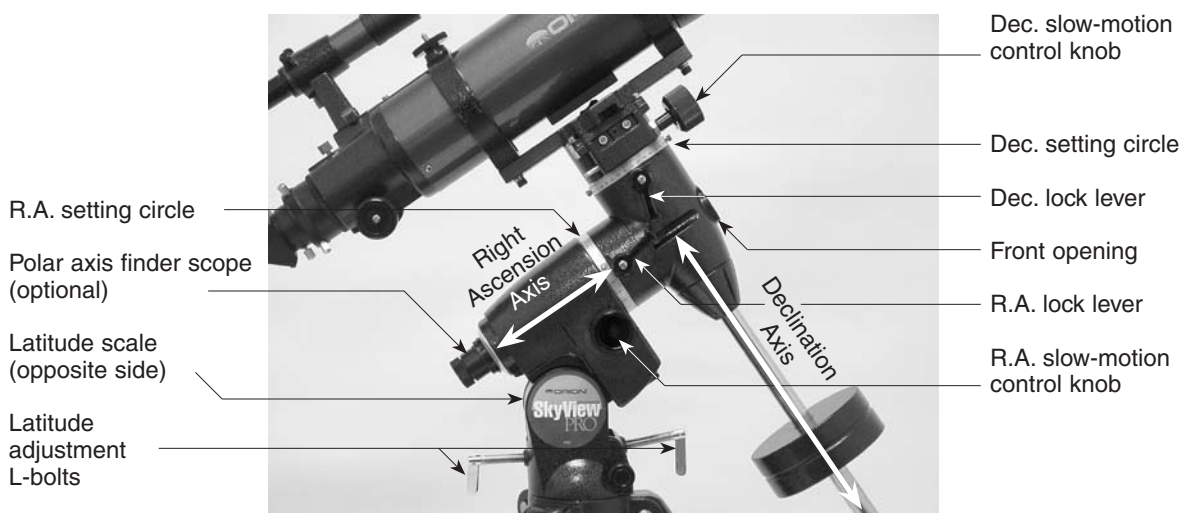
This is accomplished by slowly rotating the telescope on its right ascension (R.A.) axis, using only the R.A. slow-motion knob. But first the R.A. axis of the mount must be aligned with the Earth's rotational (polar) axis - a process called polar alignment.

### Polar Alignment

For Northern Hemisphere observers, approximate polar alignment is achieved by pointing the mount's right ascension axis



**Figure 9.** To find Polaris in the night sky, look north and find the Big Dipper. Extend an imaginary line from the two "Pointer Stars" in the bowl of the Big Dipper. Go about five times the distance between those stars and you'll reach Polaris, which lies within 1° of the north celestial pole (NCP).



**Figure 8.** The SkyView Pro mount.



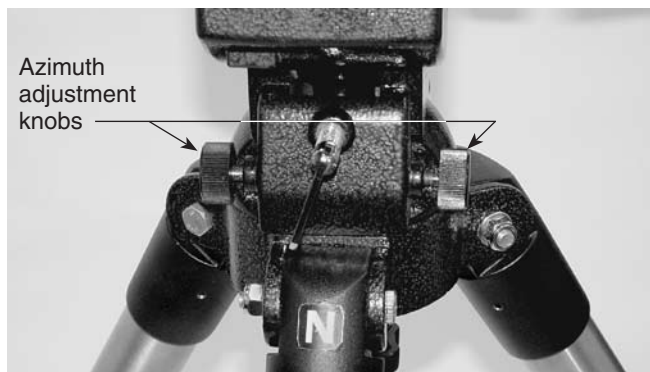
at the North Star, or Polaris. It lies within  $1^\circ$  of the north celestial pole (NCP), which is an extension of the Earth's rotational axis out into space. Stars in the Northern Hemisphere appear to revolve around the NCP.

To find Polaris in the sky, look north and locate the pattern of the Big Dipper (Figure 9). The two stars at the end of the “bowl” of the Big Dipper point right to Polaris.

Observers in the Southern Hemisphere aren't so fortunate to have a bright star so near the south celestial pole (SCP). The star Sigma Octantis lies about  $1^\circ$  from the SCP, but it is barely visible with the naked eye (magnitude 5.5).

For general visual observation, an approximate polar alignment is sufficient.

1. Level the equatorial mount by adjusting the length of the three tripod legs.
2. There are two latitude adjustment L-bolts (see Figure 8); loosen one while tightening the other. By doing this you will adjust the latitude of the mount. Continue adjusting the mount until the pointer on the latitude scale is set at the latitude of your observing site. If you don't know your latitude, consult a geographical atlas to find it. For example, if your latitude is  $35^\circ$  North, set the pointer to 35. The latitude setting should not have to be adjusted again unless you move to a different viewing location some distance away.

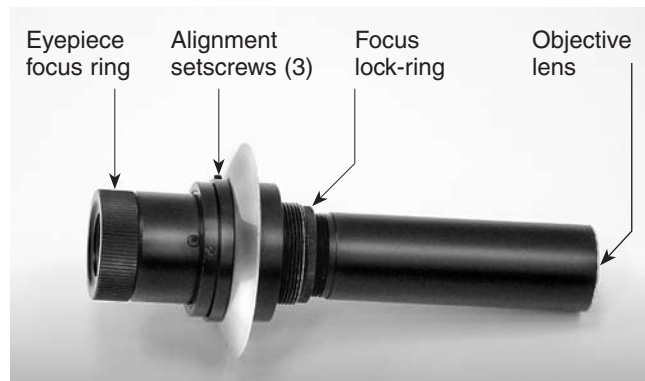


**Figure 10.** For polar alignment, position the tripod so that the “N” label at the base of the mount faces north. The azimuth fine adjustment knobs above it are used to make small adjustments to the mount's azimuth position. Be certain to loosen the tripod attachment knob on the central support shaft before adjusting these knobs.

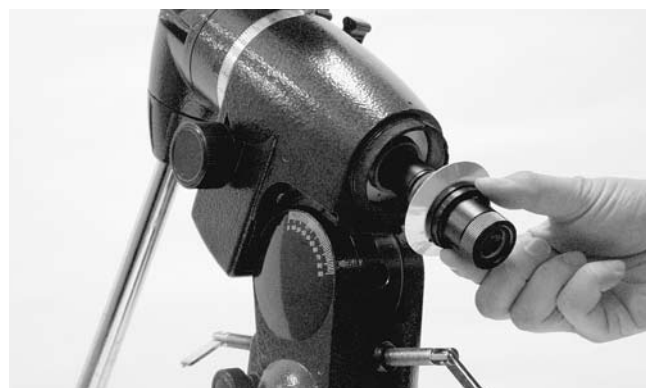
3. Loosen the Dec. lock lever and rotate the telescope's optical tube until it is parallel with the right ascension axis, as it is in Figure 8.
4. Move the tripod so the telescope tube and right ascension axis point roughly at Polaris. If you cannot see Polaris directly from your observing site, consult a compass and rotate the tripod so the telescope points north. There is a label bearing a large “N” at the base of the equatorial mount (Figure 10); it should be facing north.

The equatorial mount is now polar aligned for casual observing. More precise polar alignment is recommended for astrophotography. For this we suggest using the optional polar axis finder scope.

From this point on in your observing session, you should not make any further adjustments to the latitude of the mount, nor should you move the tripod. Doing so will undo the polar alignment. The telescope should be moved only about its R.A. and Dec. axes.



**Figure 11a.** The optional polar axis finder scope.



**Figure 11b.** Installing the optional polar axis finder scope.

### Polar Alignment Using an Optional Polar Axis Finder Scope

The SkyView Pro 80mm ED EQ mount can be equipped with an optional polar axis finder scope (Figure 11a) which goes inside the right ascension axis of the mount. The reticle of the polar axis finder scope for the SkyView Pro has a tiny star map printed on it. When properly aligned and used, it makes accurate polar alignment quick and easy to do.

To install the polar axis finder scope, remove the cover at the rear of the mount's right ascension axis and thread the polar axis finder scope into the equatorial mount until tight (Figure 11b).

If you do not have a clear view of Polaris from your observing site, you will not be able to use the polar-axis finder to precisely polar align the telescope. To align the mount using the polar axis finder scope, follow these instructions:

1. Approximately polar-align the mount as outlined in the procedure previously.
2. Loosen the Dec. lock lever and rotate the optical tube on the declination axis so that the tube is at a  $90^\circ$  to the right ascension axis (Figure 12). Tighten the Dec. lock lever. This

will allow you to view through the mount with the polar axis finder scope.

3. Remove the cap on the front of the equatorial mount (Figure 8). Focus the polar finder by rotating the eyepiece. Now, sight Polaris in the polar axis finder scope. If you have followed the approximate polar alignment procedure accurately, Polaris will probably be within the field of view. If not, move the tripod left-to-right, and adjust the latitude up-and-down (using the latitude adjustment L-bolts) until Polaris is somewhere within the field of view of the polar axis finder scope.
4. Shine a red flashlight down the front end of the polar finder to illuminate the reticle within the field of view. Make sure the flashlight shines in at an angle, so as not to block the polar finder's field of view. It may be helpful to have a friend hold the flashlight while you look through the polar finder. Note the constellation Cassiopeia and the Big Dipper in the reticle. They do not appear in scale, but they indicate the general positions of Cassiopeia and the Big Dipper relative to the north celestial pole (which is indicated by the cross at the center of the reticle). Rotate the reticle so the constellations depicted match their current orientation in the sky when viewed with the naked eye. To do this, release the R.A. lock lever and rotate the main telescope about the R.A. axis until the reticle is oriented with sky. For larger optical tubes, you may need to remove the tube from the mount to prevent it from bumping into the tripod. Once the reticle is correctly oriented, use the right ascension lock lever to secure the mount's position.
5. Now use the azimuth adjustment knobs (Figure 10) and the latitude adjustment L-bolts (Figure 8) on the mount to position the star Polaris inside the tiny circle marked "Polaris" on the finder's reticle. You must first loosen the knob underneath the equatorial mount on the center support shaft to use the azimuth adjustment knobs. Once Polaris is proper-



**Figure 12.** The optical tube must be at a 90° angle to the right ascension axis in order to view through the polar axis finder.

ly positioned within the reticle, you are precisely polar aligned. Retighten the knob underneath the equatorial mount.

From this point on in your observing session, you should not make any further adjustments in the azimuth or the latitude of the mount, nor should you move the tripod. Doing so will undo the polar alignment. The telescope should be moved only about its right ascension and declination axes.

#### **Additional Note Regarding Focusing the Polar Axis Finder Scope**

The polar axis finder scope is normally focused by simply rotating the eyepiece focus ring. However, if after adjusting the focus ring you find that the image of the reticle is sharp, but the stars are out of focus, then you must adjust the focus of the polar axis finder's objective lens. To do this, first remove the polar axis finder from the mount. Look through the polar axis finder at a star (at night) or distant object at least 1/4 mile away (during daylight). Use the eyepiece focus ring to bring the reticle into sharp focus. Now, loosen the focus lock ring (Figure 11a) and thread the entire objective end of the finder inwards or outwards until images appear sharp. Re-tighten the focus lock ring. Once the polar axis finder's objective lens is focused, it should not need to be adjusted again.

#### **Use of the Right Ascension and Declination Slow-Motion Control Knobs**

The right ascension (R.A.) and declination (Dec.) slow-motion control knobs allow fine adjustment of the telescope's position to center objects within the field of view. Before you can use the knobs, you must manually "slew" the mount to point the telescope in the vicinity of the desired target. Do this by loosening the R.A. and Dec. lock levers and moving the telescope about the mount's right ascension and declination axes. Once the telescope is pointed close to the object to be viewed, retighten both lock levers.

**Note:** If you have an optional motor drive attached, you will need to loosen the manual clutch on the R.A. (and Dec. for dual-axis drives) worm gear shaft before using the slow-motion control knob.

The object should now be visible somewhere in the telescope's finder scope. If it isn't, use the slow-motion knobs to scan the surrounding area of sky. When the object is visible in the finder scope, use the slow-motion knobs to center it. Now, look in the telescope's eyepiece. If the finder scope is properly aligned, the object should be visible somewhere in the field of view. Once the object is visible in the eyepiece, use the slow-motion knobs to center it in the field of view.

#### **Tracking Celestial Objects**

When you observe a celestial object through the telescope, you'll see it drift slowly across the field of view. To keep it in the field, if your equatorial mount is polar aligned, just turn the R.A. slow-motion control knob clockwise. The Dec. slow-motion control knob is not needed for tracking. Objects will

appear to move faster at higher magnifications, because the field of view is narrower.

### Optional Motor Drives for Automatic Tracking

An optional DC motor drive can be mounted on the R.A. axis of the equatorial mount to provide hands-free tracking. Objects will then remain stationary in the field of view without any manual adjustment of the right ascension slow-motion control knob.

### Understanding the Setting Circles

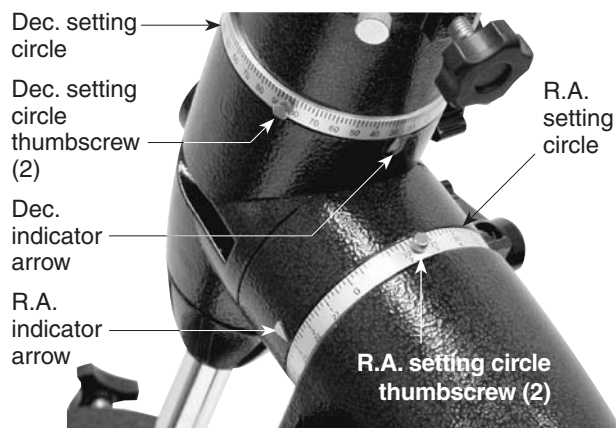
The setting circles on an equatorial mount enable you to locate celestial objects by their “celestial coordinates”. Every object resides in a specific location on the “celestial sphere”. That location is denoted by two numbers: its right ascension (R.A.) and declination (Dec.). In the same way, every location on Earth can be described by its longitude and latitude. Right ascension is similar to longitude on Earth, and declination is similar to latitude. The R.A. and Dec. values for celestial objects can be found in any star atlas or star catalog.

The R.A. setting circle is scaled in hours, from 1 through 24, with small marks in between representing 10-minute increments (there are 60 minutes in 1 hour of right ascension). The lower set of numbers apply to viewing in the Northern Hemisphere, while the numbers above them apply to viewing in the Southern Hemisphere. The location of the right ascension coordinate indicator arrow is shown in Figure 13.

The Dec. setting circle is scaled in degrees, with each mark representing 2° increments. Values of declination coordinates range from +90° to -90°. The 0° mark indicates the celestial equator. When the telescope is pointed north of the celestial equator, values of the declination setting circle are positive; when the telescope is pointed south of the celestial equator, values of the declination setting circle are negative.

So, the coordinates for the Orion Nebula listed in a star atlas will look like this:

**R.A. 5h 35.4m Dec. - 5° 27'**



**Figure 13.** The R.A. and Dec. setting circles.

That's 5 hours and 35.4 minutes in right ascension, and -5 degrees and 27 arc-minutes in declination (there are 60 arc-minutes in 1 degree of declination).

Before you can use the setting circles to locate objects, the mount must be accurately polar aligned, and the setting circles must be calibrated.

### Calibrating the Declination Setting Circle

1. Loosen the Dec. lock lever and position the telescope as accurately as possible in declination so it is parallel to the R.A. axis as shown in Figure 1. Re-tighten the lock lever.
2. Loosen one of the thumb screws on the Dec. setting circle, this will allow the setting circle to rotate freely. Rotate the Dec. setting circle until the pointer reads exactly 90°. Re-tighten the setting circle thumb screw.

### Calibrating the Right Ascension Setting Circle

1. Identify a bright star in the sky near the celestial equator (declination = 0°) and look up its coordinates in a star atlas.
2. Loosen the R.A. and Dec. lock levers on the equatorial mount, so the telescope optical tube can move freely.
3. Point the telescope at the bright star whose coordinates you know. Center the star in the telescope's field of view. Lock the R.A. and Dec. lock levers.
4. Loosen one of the R.A. setting circle thumb screws (see Figure 13); this will allow the setting circle to rotate freely. Rotate the setting circle until the R.A. pointer arrow indicates the R.A. coordinate listed in the star atlas for the object. Retighten the setting circle thumb screw.

### Finding Objects With the Setting Circles

Now that both setting circles are calibrated, look up in a star atlas the coordinates of an object you wish to view.

1. Loosen the Dec. lock lever and rotate the telescope until the declination value from the star atlas matches the reading on the Dec. setting circle. Remember that values of the Dec. setting circle are positive when the telescope is pointing north of the celestial equator (Dec. = 0°), and negative when the telescope is pointing south of the celestial equator. Retighten the lock lever.
2. Loosen the R.A. lock lever and rotate the telescope until the right ascension value from the star atlas matches the reading on the R.A. setting circle. Remember to use the lower set of numbers on the R.A. setting circle. Retighten the lock lever.

Most setting circles are not accurate enough to put an object dead-center in the telescope's eyepiece, but they should place the object somewhere within the field of view of the finder scope, assuming the equatorial mount is accurately polar aligned. Use the slow-motion controls to center the object in the finder scope, and it should appear in the telescope's field of view.



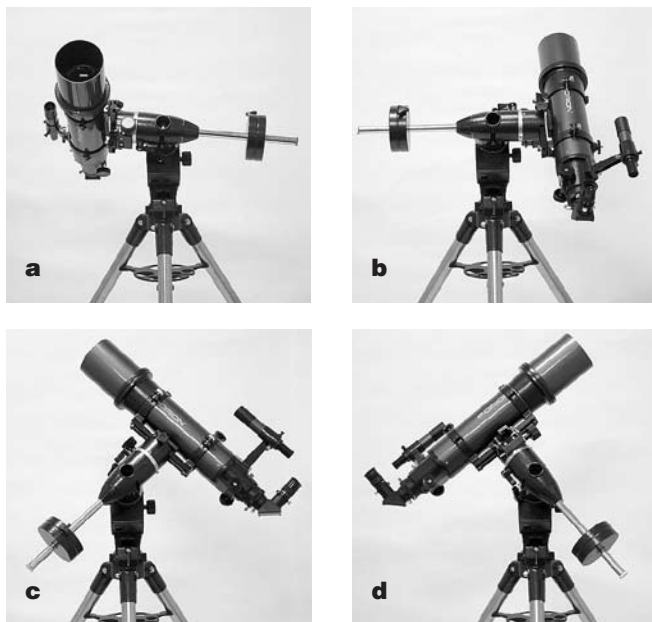
The setting circles must be re-calibrated every time you wish to locate a new object. Do so by calibrating the setting circles for the centered object before moving on to the next one.

### Confused About Pointing the Telescope?

Beginners occasionally experience some confusion about how to point the telescope overhead or in other directions. In Figure 1 the telescope is pointed north as it would be during polar alignment. The counterweight shaft is oriented downward. But it will not look like that when the telescope is pointed in other directions. Let's say you want to view an object that is directly overhead, at the zenith. How do you do it?

DO NOT make any adjustment to the latitude adjustment L-bolts. That will spoil the mount's polar alignment. Remember, once the mount is polar aligned, the telescope should be moved only on the R.A. and Dec. axes. To point the scope overhead, first loosen the R.A. lock lever and rotate the telescope on the right ascension axis until the counterweight shaft is horizontal (parallel to the ground). Then loosen the Dec. lock lever and rotate the telescope until it is pointing straight overhead. The counterweight shaft is still horizontal. Then retighten both lock levers.

What if you need to aim the telescope directly north, but at an object that is nearer to the horizon than Polaris? You can't do it with the counterweight down as pictured in Figure 1. Again, you have to rotate the scope in right ascension so that the counterweight shaft is positioned horizontally. Then rotate the scope in declination so it points to where you want it near the horizon.



**Figure 14a-d.** This illustration shows the telescope pointed in the four cardinal directions (a) north, (b) south, (c) east, (d) west. Note that the tripod and mount have been moved; only the telescope tube has been moved on the R.A. and Dec. axes.

To point the telescope directly south, the counterweight shaft should again be horizontal. Then you simply rotate the scope on the declination axis until it points in the south direction.

To point the telescope to the east or west, or in other directions, you rotate the telescope on its right ascension and declination axes. Depending on the altitude of the object you want to observe, the counterweight shaft will be oriented somewhere between vertical and horizontal.

Figure 14 illustrates how the telescope will look when pointed at the four cardinal directions: north, south, east and west.

## 7. Astronomical Observing

For many users, the SkyView Pro 80mm ED EQ telescope will be a major leap into the world of amateur astronomy. This section is intended to get you ready for your voyages through the night sky.

### Site Selection

Pick a location away from street lights and bright yard lighting. Avoid viewing over rooftops and chimneys, as they often have warm air currents rising from them which distort the image seen in the eyepiece. Similarly, you should not observe through an open or closed window from indoors. Better yet, choose a site out-of-town, away from any "light pollution". You'll be stunned at how many more stars you'll see! Most importantly, make sure that any chosen site has a clear view of a large portion of the sky.

### Seeing and Transparency

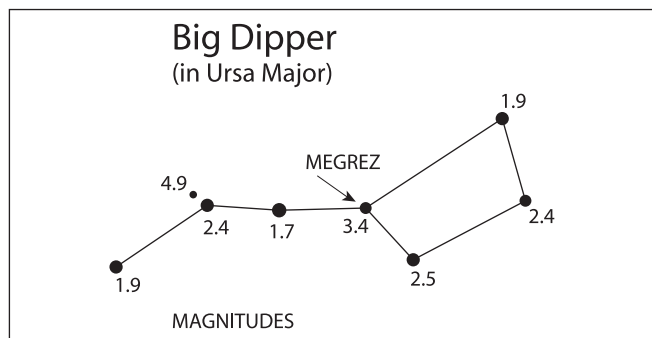
Atmospheric conditions play a huge part in quality of viewing. In conditions of good "seeing", star twinkling is minimal and objects appear steady in the eyepiece. Seeing is best overhead, worst at the horizon. Also, seeing generally gets better after midnight, when much of the heat absorbed by the Earth during the day has radiated off into space. Typically, seeing conditions will be better at sites that have an altitude over about 3000 feet. Altitude helps because it decreases the amount of distortion causing atmosphere you are looking through.

A good way to judge if the seeing is good or not is to look at bright stars about 40° above the horizon. If the stars appear to "twinkle", the atmosphere is significantly distorting the incoming light, and views at high magnifications will not appear sharp. If the stars appear steady and do not twinkle, seeing conditions are probably good and higher magnifications will be possible. Also, seeing conditions are typically poor during the day. This is because the heat from the Sun warms the air and causes turbulence.

Good "transparency" is especially important for observing faint objects. It simply means the air is free of moisture, smoke, and dust. All tend to scatter light, which reduces an object's brightness.

One good way to tell if conditions are good is by how many stars you can see with your naked eye. If you cannot see stars of magnitude 3.5 or dimmer, then conditions are poor. Magnitude is a measure of how bright a star is; the brighter a star is, the lower its magnitude will be. A good star to remem-





**Figure 15.** Megrez connects the Big Dipper's handle to its "pan". It is a good guide to how conditions are. If you can not see Megrez (a 3.4 mag star) then conditions are poor.

ber for this is Megrez (mag. 3.4), which is the star in the "Big Dipper" connecting the handle to the "dipper". If you cannot see Megrez, then you have fog, haze, clouds, smog, light pollution or other conditions that are hindering your viewing (see Figure 15).

### Cooling the Telescope

All optical instruments need time to reach "thermal equilibrium" to achieve peak performance. When moved from a warm indoor location to cooler outdoor air (or vice-versa), a telescope needs time to cool to the outdoor temperature. The bigger the instrument and the larger the temperature change, the more time will be needed.

Allow at least 30 minutes for your SkyView Pro 80mm ED EQ to equilibrate. If the scope has more than a 40° temperature adjustment, allow an hour or more. In the winter, storing the telescope outdoors in a shed or garage greatly reduces the amount of time needed for the optics to reach thermal equilibrium. It also is a good idea to keep the scope covered until the Sun sets so the tube does not heat greatly above the temperature of the outside air.

### Let Your Eyes Dark-Adapt

Do not expect to go from a lighted house into the darkness of the outdoors at night and immediately see faint nebulae, galaxies, and star clusters - or even very many stars, for that matter. Your eyes take about 30 minutes to reach perhaps 80% of their full dark-adapted sensitivity. Many observers notice improvements after several hours of total darkness. As your eyes become dark-adapted, more stars will glimmer into view and you will be able to see fainter details in objects you view in your telescope. Exposing your eyes to very bright daylight for extended periods of time can adversely affect your night vision for days. So give yourself at least a little while to get used to the dark before you begin observing.

To see what you are doing in the darkness, use a red-filtered flashlight rather than white light. Red light does not spoil your eyes' dark adaptation like white light does. A flashlight with a red LED light is ideal, or you can cover the front of a regular incandescent flashlight with red cellophane or paper. Beware, too, that nearby porch and streetlights and automobile headlights will spoil your night vision.

### Eyepiece Selection

By using eyepieces of varying focal lengths, it is possible to attain many magnifications with the SkyView Pro 80mm ED EQ. The telescope comes with two high-quality Sirius Plössl eyepieces: a 25mm, which gives a magnification of 24x, and a 10mm, which gives a magnification of 60x. Other eyepieces can be used to achieve higher or lower powers. It is quite common for an observer to own five or more eyepieces to access a wide range of magnifications. This allows the observer to choose the best eyepiece to use depending on the object being viewed. At least to begin with, the two supplied eyepieces will suffice nicely.

Whatever you choose to view, always start by inserting your lowest power (longest focal length) eyepiece to locate and center the object. Low magnification yields a wide field of view, which shows a larger area of sky in the eyepiece. This makes acquiring and centering an object much easier. If you try to find and center objects with high power (narrow field of view), it's like trying to find a needle in a haystack!

Once you've centered the object in the eyepiece, you can switch to higher magnification (shorter focal length eyepiece), if you wish. This is especially recommended for small and bright objects, like planets and double stars. The Moon also takes higher magnifications well.

Deep-sky objects, however, typically look better at medium or low magnifications. This is because many of them are quite faint, yet have some extent (apparent width). Deep-sky objects will often disappear at higher magnifications, since greater magnification inherently yields dimmer images. This is not the case for all deep-sky objects, however. Many galaxies are quite small, yet are somewhat bright, so higher power may show more detail.

The best rule of thumb with eyepiece selection is to start with a low power, wide field, and then work your way up in magnification. If the object looks better, try an even higher magnification. If the object looks worse, then back off the magnification a little by using a lower power eyepiece.

### Astronomical Objects

Now that you are all set up and ready to go, one critical decision must be made: what to look at?

#### A. The Moon

With its rocky and cratered surface, the Moon is one of the most interesting and easy subjects to view with your scope. The best time to view it is during its partial phases when shadows fall on the craters and canyon walls to give them definition. While the full moon may look like a tempting target, it is not optimal for viewing. The light is too bright and surface definition is low.

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Even at partial phases, the Moon is very bright. Use of an optional Moon filter helps to dim the view. It simply threads onto the bottom of the eyepiece. You'll find the Moon filter improves viewing comfort, and helps bring out the subtle features of the lunar surface.

## **B. The Sun**

You can change your nighttime telescope into a daytime Sun viewer by installing an optional full-aperture solar filter over the front opening of the telescope. The primary attraction is sunspots, which change shape, appearance, and location daily. Sunspots are directly related to magnetic activity in the Sun. Many observers like to make drawings of sunspots to monitor how the Sun is changing from day to day.

**Important Note:** *Do not look at the Sun with any optical instrument without a professionally made solar filter, or permanent eye damage could result. Also, be sure to cover the finder scope, or better yet, remove it altogether.*

## **C. The Planets**

The planets don't stay put like the stars, so to find them you should refer to Sky Calendar at our website, [telescope.com](http://telescope.com), or to charts published monthly in *Astronomy*, *Sky & Telescope*, or other astronomy magazines. Venus, Mars, Jupiter, and Saturn are the brightest objects in the sky after the Sun and the Moon. Your SkyView Pro 80mm ED EQ is capable of showing you these planets in detail. Other planets may be visible but will likely appear starlike. Because planets are quite small in apparent size, optional higher power eyepieces are recommended, and often needed, for detailed observations. Not all the planets are generally visible at any one time.

**JUPITER** The largest planet, Jupiter, is a great subject for observation. You can see the disk of the giant planet and watch the ever-changing positions of its four largest moons: Io, Callisto, Europa, and Ganymede. Higher power eyepieces should bring out the cloud bands on the planet's disk and the Great Red Spot.

**SATURN** The ringed planet is a breathtaking sight. The tilt angle of the rings varies over a period of many years; sometimes they are seen edge-on, while at other times they are broadside and look like giant "ears" on each side of Saturn's disk. A steady atmosphere (good seeing) is necessary for a good view. Look closely and you may see the Cassini division, a thin, dark gap in the rings. You should also see one or more of Saturn's moons, which look like faint stars. The brightest is the moon Titan.

**VENUS** At its brightest, Venus is the most luminous object in the sky, excluding the Sun and the Moon. It is so bright that sometimes it is visible to the naked eye during full daylight! Ironically, Venus appears as a thin crescent, not a full disk, when at its peak brightness. Because it is so close to the Sun, it never wanders too far from the morning or evening horizon. No surface markings can be seen on Venus, which is always shrouded in dense clouds.

**MARS** The Red Planet makes a close approach to Earth every two years. Observing Mars is most favorable at these times. With good conditions, you may see a salmon-colored

disk with some distinct dark patches, and you might be able to spot a whitish polar ice cap. To see surface detail on Mars, you will need a high power eyepiece and very steady air!

## **D. The Stars**

Stars will appear as tiny points of light. Even the largest telescopes cannot magnify stars to appear as anything more than pinpoints. You can, however, enjoy the different colors of the stars and locate many pretty double and multiple stars. The famous "Double-Double" in the constellation Lyra and the gorgeous two-color double star Albireo in Cygnus are favorites. Defocusing a star slightly can help bring out its color.

## **E. Deep-Sky Objects**

Under dark skies, you can observe a wealth of fascinating deep-sky objects; that is, objects that reside outside of our solar system. These include gaseous nebulae, open and globular star clusters, and a variety of different types of galaxies. For deep-sky observing it is important that you find an observing site well away from light pollution. Take plenty of time to let your eyes adjust to the darkness. As you become more experienced and your observing skills get sharper, you will be able to ferret out more and more subtle details and structure from these fascinating objects.

Beginners are often surprised to discover that the deep-sky objects they see through the eyepiece of a telescope are mostly grayish, not colorful like those you see in long-exposure photographs. The reason is that our eyes are not sensitive to color in faint light. Still, there is something very special about seeing an astronomical object in real time, with your own eyes — "live," if not in living color.

## **How to Find Deep-sky Objects: Starhopping**

Starhopping, as it is called by astronomers, is perhaps the simplest way to hunt down objects to view in the night sky. It entails first pointing the telescope at a star close to the object you wish to observe, and then progressing to other stars closer and closer to the object until it is in the field of view of the eyepiece. It is a very intuitive technique that has been employed for hundreds of years by professional and amateur astronomers alike. Keep in mind, as with any new task, that starhopping may seem challenging at first, but will become easier over time and with practice.

To starhop, only a minimal amount of additional equipment is necessary. A star chart or atlas that shows stars to at least magnitude 5 is required. Select one that shows the positions of many deep-sky objects, so you will have a lot of options to choose from. If you do not know the positions of the constellations in the night sky, you will need to get a planisphere to identify them.

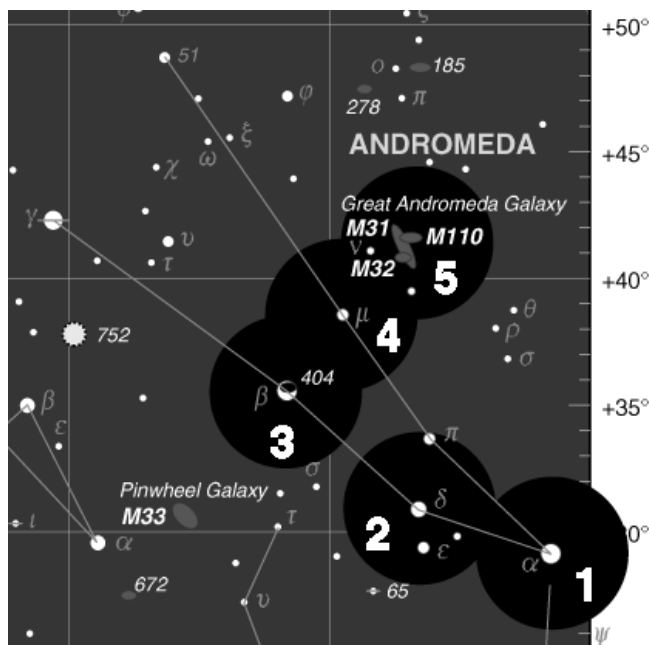
Start by choosing bright objects to view. The brightness of an object is measured by its visual magnitude; the brighter an object, the lower its magnitude. Choose an object with a visual magnitude of 9 or lower. Many beginners start with the Messier objects, which represent some of the best and brightest deep-sky objects. These were first catalogued about 200 years ago by the French astronomer Charles Messier.

Determine in which constellation the object lies. Now, find the constellation in the sky. If you do not recognize the constellations on sight, consult a planisphere. The planisphere gives an all-sky view and shows which constellations are visible on a given night at a given time.

Now, look at your star chart and find the brightest star in the constellation that is near the object you are trying to find. Using the finder scope, point the telescope at this star and center it on the crosshairs. Next, look again at the star chart and find another suitably bright star near the bright star currently centered in the finder. Keep in mind that the field of view of the finder scope is approximately  $5^\circ$ , so you should choose another star that is no more than  $5^\circ$  from the first star, if possible. Move the telescope slightly, until the telescope is centered on the new star.

Continue using stars as guideposts in this way until you are at the approximate position of the object you are trying to find (Figure 16). Look in the telescope's eyepiece, and the object should be somewhere within the field of view. If it's not, sweep the telescope carefully around the immediate vicinity until the object is found.

If you have trouble finding the object, start the starhop again from the brightest star near the object you wish to view. This time, be sure the stars indicated on the star chart are in fact the stars you are centering in the eyepiece. Remember, the finder scope (and main telescope eyepiece, for that matter) gives an inverted image, so you must keep this in mind when starhopping from star to star.



**Figure 16.** Starhopping is a good way to locate hard-to-find objects. Refer to a star chart to map a route to the object that uses bright stars as guideposts. Center the first star you've chosen in the finder scope and telescope eyepiece (1). Now move the scope carefully in the direction of the next bright star (2), until it is centered. Repeat (3 and 4). The last hop (5) should place the desired object in the eyepiece.

## 8. Terrestrial Observing

The SkyView Pro 80mm ED optical tube can be used for long-distance viewing over land. For this we recommend using an optional 1.25"  $45^\circ$  correct-image diagonal instead of the provided 2"  $90^\circ$  mirror star diagonal. The correct-image diagonal will yield non-reversed images and provides a more comfortable viewing angle. To install the correct-image diagonal, first remove the 2" diagonal from the focuser drawtube by loosening the two thumb screws on the drawtube. Now, place the "camera adapter" that came attached to the telescope (see Figure 4) into the focuser drawtube, and secure it with the two thumb screws on the drawtube. Now, place the correct-image diagonal into the camera adapter, and secure it with the thumb screw on the camera adapter. Place an eyepiece into the diagonal, secure it with the thumb screw on the diagonal, and you're ready for daytime viewing.

An optional altazimuth mount or a sturdy camera tripod, as opposed to the SkyView Pro equatorial mount, is recommended for terrestrial viewing. This is because the equatorial mount is designed for tracking the motion of stars, and is not easy to aim at terrestrial objects. Remove the telescope from the SkyView Pro's tube rings, and you will notice the optical tube has a mounting block on it. The mounting block will accept a  $1/4$ "-20 thread used on most camera tripods.

For terrestrial viewing, it's best to stick with low power eyepieces that yield a magnification of under 100x. At higher powers, images rapidly lose sharpness and clarity due to "heat waves" caused by Sun-heated air.

Remember to aim well clear of the Sun, unless the front of the telescope is fitted with a professionally made solar filter and the finder scope is covered by an opaque material or removed altogether.

## 9. Astrophotography

With the included camera adapter, the SkyView Pro 80mm ED becomes a 600mm f/7.5 telephoto lens for a single-lens reflex camera. For long-distance terrestrial or astronomical photography, you need only a T-ring for your particular camera model. The T-ring attaches to your particular camera model and threads onto the camera adapter, coupling the camera body to the camera adapter. The camera adapter connects to the telescope in place of the 2" star diagonal. Remove the 2" diagonal by first loosening the two thumb screws on the focuser drawtube. Insert the camera adapter (with camera attached), and secure with the drawtube's thumb screws.

Use the camera's viewfinder to frame the picture. If you wish to rotate the field of view, simply loosen the two thumb screws on the focuser drawtube and rotate the camera body. Retighten the thumb screws once the desired orientation is achieved. Use the telescope's focuser to focus the image. Tighten the focuser tension thumb screw to make sure the camera does not slip out of focus.

You may want to consider using a remote shutter release instead of the shutter release on the camera. Touching the

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camera can vibrate the system and blur the resulting photographic image.

### **Moon Photography**

This is perhaps the simplest form of astrophotography, as no motor drive is required. Point the telescope toward the Moon, and center it within the camera's viewfinder. Focus the image with the telescope's focuser. Try several exposure times, all less than 1 second, depending on the phase of the moon and the ISO (film speed) of the film being used. A remote shutter release is recommended, as touching the camera's shutter release can vibrate the camera enough to ruin the exposure.

### **Planetary Photography**

Once basic Moon photography has been mastered, it's time to get images of the planets. This type of astrophotography also works to get highly magnified shots of the Moon. In addition to the T-ring, you will need an optional Universal 1.25" Camera Adapter. The TrueTrack Motor Drive System (single or dual-axis) is also required. This is because a longer exposure is necessary, which would cause the image to blur if no motor drive was used for tracking. The equatorial mount must be accurately polar aligned, too.

As before, connect the T-ring to your camera. Before connecting the universal camera adapter to the T-ring, an eyepiece must be inserted and locked into the body of the universal camera adapter. Start by using a medium-low power eyepiece (about 25mm); you can increase the magnification later with a high-power eyepiece. Then connect the entire camera adapter, with eyepiece inside, to the T-ring. Insert the whole system into the focuser (with the camera adapter that comes with the telescope attached to the drawtube) and secure firmly with the thumb screws.

Aim the telescope at the planet (or Moon) you wish to shoot. The image will be highly magnified, so you may need to use the finder scope to center it within the camera's viewfinder. Turn the motor drive on. Adjust the telescope's focuser so that the image appears sharp in the camera's viewfinder. The camera's shutter is now ready to be opened. A remote shutter release must be used or the image will be blurred beyond recognition. Try exposure times between 1 and 10 seconds, depending upon the brightness of the planet to be photographed and the ISO of the film being used.

### **"Piggyback Photography"**

The Moon and planets are interesting targets for the budding astrophotographer, but what next? Literally thousands of deep-sky objects can be captured on film with a type of astrophotography called "piggybacking". The basic idea is that the camera with its own camera lens attached rides on top of the main telescope. The telescope and camera both move with the rotation of the Earth when the mount is polar aligned and the motor drive is engaged. This allows for a long exposure through the camera without having the object or background stars blurred. In addition to the motor drive (dual-axis), an illuminated reticle eyepiece is also needed. The T-ring and camera adapter are not needed, since the camera is expos-

ing through its own lens. Any camera lens with a focal length between 35mm and 400mm is appropriate.

On the top of one of the tube rings is a piggyback camera adapter. This is the black knob with the threaded shaft protruding through it. The tube ring with the piggyback adapter should be closest to the front end of the telescope tube. Remove the tube rings from the equatorial mount and swap their position if necessary. Now, connect the camera to the piggyback adapter. There should be a 1/4"-20 mounting hole in the bottom of the camera's body. Thread the protruding shaft of the piggyback adapter into the 1/4"-20 mounting hole in the camera a few turns. Position the camera so it is parallel with the telescope tube and turn the knurled black knob of the piggyback adapter counter-clockwise until the camera is locked into position.

Aim the telescope at a deep-sky object. It should be a fairly large deep-sky object, as the camera lens will likely have a wide field of view. Check to make sure that the object is also centered in the camera's viewfinder. Turn the motor drive on. Now, look into the telescope's eyepiece and center the brightest star within the field of view. Remove the eyepiece and insert the illuminated reticle eyepiece into the focuser drawtube. Turn the eyepiece's illuminator on (dimly!). Recenter the bright star (guide star) on the crosshairs of the reticle eyepiece. Check again to make sure that the object to be photographed is still centered within the camera's field of view. If it is not, recenter it by repositioning the camera on the piggyback adapter, or by moving the main telescope. If you move the main telescope, then you will need to recenter another guide star on the illuminated eyepiece's crosshairs. Once the object is centered in the camera and a guide star is centered in the reticle eyepiece, you're ready to shoot.

Deep-sky objects are quite faint, and typically require exposures on the order of 10 minutes. To hold the camera's shutter open this long, you will need a locking shutter release cable. Set the camera's shutter to the "B" (bulb) setting. Depress the locking shutter release cable and lock it. You are now exposing your first deep-sky object.

While exposing through the camera lens, you will need to monitor the accuracy of the mount's tracking by looking through the illuminated reticle eyepiece in the main telescope. If the guide star drifts from its initial position, then use the hand controller of the motor drive to "move" the guide star back to the center of the crosshairs. Any drifting along the Dec. axis is a result of improper polar alignment, so if the guide star drifts greatly in Dec., the mount may need to be polar aligned more accurately.

When the exposure is complete, unlock the shutter release cable and close the camera's shutter.

Astrophotography can be enjoyable and rewarding, as well as frustrating and time-consuming. Start slowly and consult outside resources, such as books and magazines, for more details about astrophotography. Remember....have fun!



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## 10. Care and Maintenance

If you give your telescope reasonable care, it will last a lifetime. Store it in a clean, dry, dust-free place, safe from rapid changes in temperature and humidity. Do not store the telescope outdoors, although storage in a garage or shed is OK. Small components like eyepieces and other accessories should be kept in a protective box or storage case. Keep the dust cover on the front of the telescope when not in use.

Your SkyView Pro 80mm ED EQ requires very little mechanical maintenance. The optical tube is aluminum and has a smooth painted finish that is fairly scratch-resistant. If a scratch does appear on the tube, it will not harm the telescope. Smudges on the tube can be wiped off with a soft cloth and a household surface cleaner.

### Cleaning Lenses

Any quality optical lens cleaning tissue and optical lens cleaning fluid specifically designed for multi-coated optics can be used to clean the exposed lenses of your telescope's objective lens, eyepieces, or finder scope. Never use regular glass cleaner or cleaning fluid designed for eyeglasses. Before cleaning with fluid and tissue, blow any loose particles off the lens with a blower bulb or compressed air. Then apply some cleaning fluid to a tissue, never directly on the optics. Wipe the lens gently in a circular motion, then remove any excess fluid with a fresh lens tissue. Oily fingerprints and smudges may be removed using this method. Use caution; rubbing too hard may scratch the lens. On larger lenses, clean only a small area at a time, using a fresh lens tissue on each area. Never reuse tissues.

## 11. Specifications

Objective lens: Apochromatic, rear element made of ED glass, air-spaced

Objective lens coating: Fully multi-coated

Objective lens diameter: 80mm (3.1")

Focal Length: 600mm

Focal Ratio: f/7.5

Optical tube: Seamless aluminum

Lens cell: Machined aluminum

Focuser: Crayford, accepts 1.25" or 2" accessories and camera T-ring (with adapter)

Eyepieces: 25mm and 10mm Sirius Plössls, fully coated with multi-coatings, 1.25", accept Orion filters

Magnification: 24x (with 25mm) and 60x (with 10mm)

Finder Scope: 8x40 Achromatic, 5.33° field of view, crosshairs

Diagonal: 2" Star diagonal, mirror type, includes 1.25" adapter

1/4"-20 Mounting block: Allows direct attachment of telescope to camera tripod

Mount: SkyView Pro, German equatorial

Counterweight: 7.5 lbs

Tripod legs: Steel

Tripod support tray: Aluminum, provides additional stability, holds five 1.25" eyepiece and two 2" eyepieces

Weight: 36 lbs. (Mount 30 lbs., optical tube 6 lbs.)

Polar axis latitude adjustment: 8° to 70°

Polar axis finder: Optional

Motor Drives: Optional

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## **One-Year Limited Warranty**

This Orion SkyView Pro 80mm ED EQ is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid to: Orion Warranty Repair, 89 Hangar Way, Watsonville, CA 95076. If the product is not registered, proof of purchase (such as a copy of the original invoice) is required.

This warranty does not apply if, in Orion's judgment, the instrument has been abused, mishandled, or modified, nor does it apply to normal wear and tear. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. For further warranty service information, contact: Customer Service Department, Orion Telescopes & Binoculars, 89 Hangar Way, Watsonville, CA 95076; (800) 676-1343.

### **Orion Telescopes & Binoculars**

**89 Hangar Way, Watsonville, CA 95076**

**Customer Support Help Line (800) 676-1343 • Day or Evening**

**OrionTelescopes.com**